

NCEP Quarterly Newsletter - December 2013



EMC NCEP Production Suite Review

The National Centers for Environmental Protection (NCEP) Production Suite Review (NPSR) is an annual meeting hosted by the NCEP Environmental Modeling Center. The 2013 NPSR was held at the NOAA Center for Weather and Climate Prediction (NCWCP) in College Park, Maryland on 03-05 December. This conference is designed to present near-term (1-2 years) production suite upgrades and foster discussion on the longer term (3+ years) strategies for data assimilation, convective resolving modeling and coupled atmosphere/ocean/land/ice modeling to capture the weather to climate regime. The meeting also provides stakeholders in NWS Regions, academia and private industry to provide feedback to NCEP to identify priority areas for future model development.

This year's NPSR was attended by representatives from each of the NCEP centers and National Weather Service (NWS) regions. The presentation quality was exceptional and the feedback provided by participants has been positive. Approximately 100 individuals attended the conference this year, nearly double the number of attendees from last year's event and largest attendance in several years. Three panel discussions were held and were a popular component of the meeting. The topics covered in the panel discussions included: 1) developing need for reforecasts from the medium range global ensemble system; 2) the issue of Big Data--how the NWS must be able to efficiently and effectively disseminate large volumes of production suite products to customers; and 3) the evolution of the COUNUS operational high resolution ensemble system.

The presentations from the 2013 NPSR can be found at the following website:

<http://www.emc.ncep.noaa.gov/annualreviews/NCEPmodelReview-2013.html>



EMC 6th WMO Symposium on Data Assimilation

Improving the quality of prediction requires advancement in theory, modeling, observing systems, and computing capacity. These advancements, in turn, lead to advances in our understanding of the system itself. Dealing with the inherent uncertainty of environmental prediction is one of the major issues facing earth system sciences. As a result, society is looking for further significant benefits from the applications of data assimilation. It is therefore essential that the data assimilation community continues to meet to review and plan research and development. Given the importance of this topic across both operations and research, international partnerships across governmental organizations and academia are also required. Since the World Meteorological Organization (WMO) accepted the challenge of overseeing the development of data assimilation practices, there have been tremendous developments in the relevant areas of science and technology. A series of five symposia, starting in Clermont-Ferrand, (France, 1990), followed by Tokyo (Japan, 1995), Quebec City (Canada, 1999), Prague (Czech Republic, 2005), and Melbourne (Australia, 2009), has been an important part of showcasing these developments and reporting on what fruitful directions research might take in order to meet increasing operational and societal demands. Following this path, the 6th Symposium was organized under the auspices of the WMO World Weather Research Program (WWRP). Over 300 international participants came together in College Park, MD on 07-11 October 2013. Sponsorship by NASA, NOAA, NSF, and the University of Maryland made it possible to provide domestic and international travel support to eight early-career scientists.

The Symposium's main goals were to: i) Assess recent progress in atmospheric, oceanographic, and hydrologic data assimilation, in both research and operational environments; and ii) Reach a common understanding of the main challenges and opportunities that lie ahead in data assimilation. The Symposium consisted of nine main themes: Global and Regional Atmospheric Data Assimilation; Convective Scale Data Assimilation; Atmospheric Constituent Data Assimilation; Coupled Data Assimilation; Global and Regional Ocean Data Assimilation; Assimilation of Observations for the Land Surface; Assimilation of Satellite, In Situ, and Radar Observations; Methodology; and Diagnostic Tools. A total of 74 oral and 227 poster presentations were made from a wide range of perspectives representing the cross-disciplinary nature of data assimilation, which led to stimulating discussion and interaction. In the final oral session, the summary and conclusions of each theme were presented to highlight notable advances in recent years, and to identify pressing issues and challenges for the future.

The 6th WMO Symposium website (<http://das6.umd.edu>) contains all abstracts and most presentations (in both slides and video recording), and provides a valuable resource to the data assimilation community and beyond. A special collection of articles in the American Meteorological Society (AMS) journals highlighting the work presented at the Symposium is being assembled, and will include a brief, online-only summary article.

Despite its coincidental concurrence with the U.S. federal government shutdown, forcing a last minute relocation of the venue from NCWCP to the University of Maryland Riggs Alumni Center, the 6th WMO Symposium on Data Assimilation was a huge success thanks to everyone's contributions, and particularly to those of the local volunteers, whose devoted efforts were essential. The Local Organizing Committee is also grateful for the partnership of the University of Maryland, which made the overhaul possible.



A large turnout for a session of the 6th WMO Symposium on Data Assimilation, held at the University of Maryland Riggs Alumni Center in College Park, MD. (Photo by Michiko Masutani)



Attendees review posters during a break at the 6th WMO Symposium on Data Assimilation. (Photo by Michiko Masutani)

Service Center Activities

AWC Flight Deck Technology Test

The NASA Airspace Systems Program (NASA Langley) is developing and exploring the concept of Traffic Aware Strategic Aircrew Requests (TASAR). TASAR will include a cockpit decision support system that identifies optimization opportunities that are probed and cleared of known separation violations prior to issuing the request to ATC. TASAR leverages Automatic Dependent Surveillance Broadcast (ADS-B) to check trajectory changes for potential conflicts.

As conditions change during flight, it is common for the aircrew to request an amendment to their ATC-cleared trajectory to meet some need for safety, efficiency, or comfort. Aircrew requests are made with little or no awareness of the traffic situation or ATC sector considerations. Some of these requests are denied

because they conflict with other traffic, are counter to sector procedures, or are requested too close to the next sector handoff. Denied requests place an unnecessary workload burden on the controllers and discourage pilots from making future requests to improve their flight. In addition, some flight improvement opportunities are unrealized because pilots may not be aware of requests that would improve efficiency and be ATC approvable.

TASAR uses a software application resident on a Class 2 Electronic Flight Bag (EFB). The TASAR application has read-only access to the aircraft systems for data such as current aircraft performance parameters, the active route, and sensed wind and temperature. It will connect to an ADS-B receiver for traffic surveillance and use existing airborne internet access for supplemental traffic and airspace information. Real-time weather products showing convection, forecasts, winds aloft, and other atmospheric information will be accessible by the TASAR application over the airborne internet and/or other data links.



Flight Test Pilot John Maris and Copilot Bob Maxson compare notes during post-flight debriefing after flight testing the TASAR flight-deck pilot interface in Hampton, VA on November 14, 2013. The electronic flight bag supporting the interface is on the table immediately to Maxson's right.

The TASAR application has several operating modes. An automatic mode will continually scan for lateral and vertical changes that produce significant time or fuel savings and will propose them for request from ATC at the aircrew's discretion. A manual mode will allow pilots to enter a change proposed by dispatch or the aircrew and check it for acceptability before request. Both modes will account for the traffic situation, sector procedures, and other known constraints in determining acceptability.

Aviation Weather Center Director Bob Maxson teamed up with NASA Langley's David Wing (TASAR PI), and Marinvent's flight test crew led by CEO and flight test director John Maris to test the TASAR pilot interface under actual flight conditions in Marinvent's Piaggio 180 research aircraft. After several hours of preflight training, Maxson and the flight crew were able to use this amalgamation of NextGen technologies to shave nearly 20 minutes off the preloaded three-hour flight plan by making requests to ATC controllers based on known conflicting traffic information (as reported by ADS-B input data) as well as NWS numerical wind guidance sent directly to the aircraft in near-real time. It is anticipated additional weather feeds and SIGMET information will be introduced into TASAR and will act as further in-flight constraints (beyond conflicting air traffic) which will then be considered by the routing optimization software. The planned introduction of weather objects (as derived from the "NextGen weather cube") into the TASAR software, again in near-real time, offers a natural connection between NASA and the NWS in supporting this meaningful NextGen technology development aimed to enhance the safety and the efficiency of future airline operations.



Depiction of the TASAR pilot interface optimization software operating in the automatic mode.

AWC Ask a Meteorologist Day

Building on the success and popularity of Aviation Weather Center's social media efforts, AWC hosted an interactive "Ask A Meteorologist Day" on Facebook. One contributor to AWC's Facebook popularity is our customers enjoyment when we post informative and educating weather information. AWC Forecaster and Facebook lead, Karen Eagle hosted the "Ask a Meteorologist Day" via Facebook. For the day Facebook friends could ask Karen anything regarding aviation weather, weather in general or about our AWC and NWS operations.

The "day" was an entire 8 hours (8 am to 4 pm). Friends could post questions on the AWC Facebook page, and others could post follow up questions to the original update on our wall. Karen was surprised by the variety and volume of questions. Many of the questions did not really pertain to aviation weather, or to the AWC and NWS. Karen said, "I did my best to answer their questions regardless of topic."

Right off the bat, questions came quickly and Karen struggled to keep up. "But after about 2-3 hours it slowed down", Karen admitted with a smile.

There were a few questions specific to aviation weather, however many were about flying in general. Some question topics were; Aviation (flight) simulators, taking weather observation, understanding cloud heights, ground speed vs air speed and wanting to know why the pilot was seeing fluctuations in these speeds.

"Ask a Meteorologist Day was definitely a learning experience for me and the customers", Karen stated. After it was over she posted a thank you to everyone participating and received messages thanking her for her time and expressing their desire to do it again.



Screen shot from the AWC Facebook page.

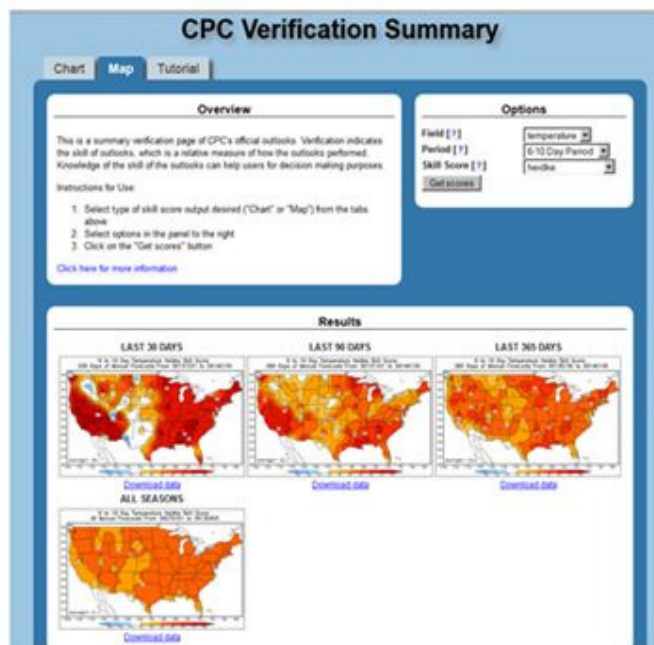
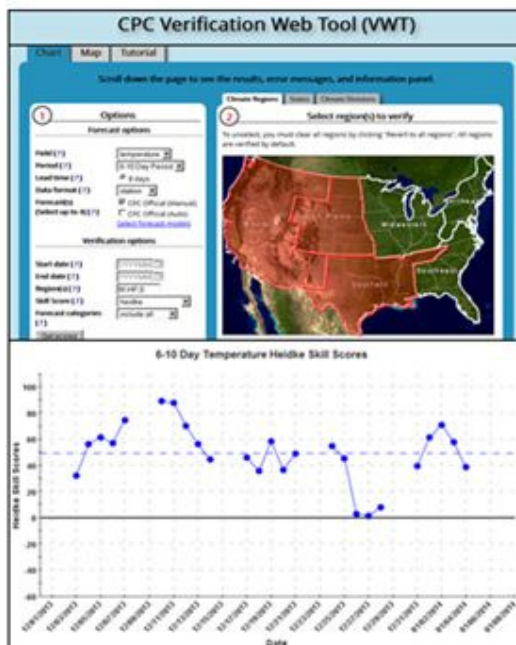
CPC Verification Web Pages

The Climate Prediction Center released new verification web pages at the end of 2013. These pages include both a static summary verification web page (figure, right) as well as a dynamic Verification Web Tool (VWT) (figure, left). The goal of the former is to allow quick access to some standard, commonly requested validation information, while the latter is designed to allow users to interactively get forecast verification information from the database in both time series and spatial map formats. For time series plots, the user has control over the time period selected and the choice of spatial domain (CONUS, climate regions, more specific climate divisions and states). Spatial maps are also available with the user having the ability to aggregate verification statistics over months and seasons as well as by various climate phenomena such as El Niño.

The verification information currently focuses on the CPC extended range (Days 6-10 / Days 8-14), and long-range (monthly and seasonal) outlooks and their associated forecast tools. Verification scores are available based on both station and gridded data and incorporates basic CPC skill scores such as the Heidke skill score, as well as new skill score types previously not available to the user, such as the Ranked Probability Skill Score (RPSS), Brier Skill Score (BSS) and reliability diagrams. Stratification by forecast category (i.e., above-, near- or below-average terciles) is also available. The links to the static summary and VWT verification pages are listed below.

<http://www.cpc.ncep.noaa.gov/products/verification/summary/>

<http://vwt.ncep.noaa.gov/>



Screen shots of the dynamic CPC Verification Web Tool (left) and the CPC Verification Summary page (right).

NHC Tropical Storm Karen

No sooner had the U.S. government shutdown begun than Tropical Storm Karen formed in the Gulf of Mexico on October 3rd, potentially becoming the first U.S. landfalling hurricane of the season. NHC remained operational during the shutdown, issuing a Tropical Storm Warning and a Hurricane Watch for portions of the U.S. Gulf coast from Louisiana to the Florida Panhandle. The NHC television media pool was opened, providing more than three dozen interviews regarding the approaching storm.

Fortunately, thanks to dry air and wind shear, Karen weakened and dissipated before reaching land.



NHC Director Dr. Rick Knabb provides a live television interview regarding the expected impacts of Tropical Storm Karen.

NHC CARCAH Retirement

NHC bid farewell and happy retirement to Warren Von Werne during a luncheon on October 29th at its Miami facility. Warren was a 23 and a half year employee of the U.S. Air Force and was assigned to NHC's CARCAH (Chief Aerial Reconnaissance Coordination All Hurricanes) Unit.

His duties included the coordination of the flying activities of the USAF and NOAA Hurricane Hunter aircraft which don't just include tropical cyclones. The planes also fly into winter storms.



NHC Director Dr. Rick Knabb presents a signed farewell card to Warren Von Werne.

OPC Experimental Lightning Strike Density

The Ocean Prediction Center (OPC) introduced a new experimental web product in October 2013 called Lightning Strike Density. Graphical images of the gridded number of lightning strikes over a given time period overlaid with GOES satellite visible and IR satellite imagery are available for the Atlantic and Pacific offshore waters at: <http://www.opc.ncep.noaa.gov>. Click on the link titled ***Experimental lightning strike density product a useful tool for mariners***. These gridded values are available over 15 and 30 minute collective periods and are updated 24 hours per day. Thunderstorm activity at sea can have significant impacts to the safety of mariners and impact marine operations. Presently only satellite imagery gives mariners at sea an indication of thunderstorm activity beyond the land-based NWS WSR-88D weather radar coverage. Satellite imagery provides the large scale view over the oceans, but does not provide definitive information concerning whether a particular cloud system is producing lightning.

The purpose of the lightning strike density product is to enhance awareness of developing and transitory thunderstorm activity by giving users the ability to determine whether a cloud system is producing lightning, if that activity is increasing or decreasing, and to emulate the future GOES-R satellite Global Lightning Mapper (GLM) data. Since the graphics are provided in an animated format, the general direction and speed the lightning activity is moving can also be inferred from the web-based product. Hazards from thunderstorms include reduced visibility, saturation of collision avoidance radar due to attenuation from heavy rain, rapidly increasing and shifting winds, building waves, and lightning. Sailing vessels and small fishing vessels are particularly vulnerable to rapidly degrading conditions associated with thunderstorms, especially those operating over the open ocean beyond the land based radar systems.

OPC has been working with two student interns to evaluate the lightning density product and begin to establish methodology for its use as well as best practices for marine forecasters. Cadet Alexandra Stinner from the United States Coast Guard Academy evaluated three warm season cases of severe convective storms (April through September) that transitioned from land to the coastal and offshore waters. She presented her findings at the 2014 American Meteorological Society Student Conference and continues to evaluate other

warm season cases to identify the different modes of convection and their associated lightning density signals. University of Maryland meteorology student Colleen Wilson is building upon Cadet Stinner's work by evaluating a series of cold season (October through March) convective outbreaks for their similar lightning density signals tied to convective mode.

OPC is always seeking to improve the availability and quality of NWS products and services based on user feedback. Comments regarding the experimental Lightning Strike Density Product may be submitted via a short survey:

<http://www.nws.noaa.gov/survey/nws-survey.php?code=LSDP>

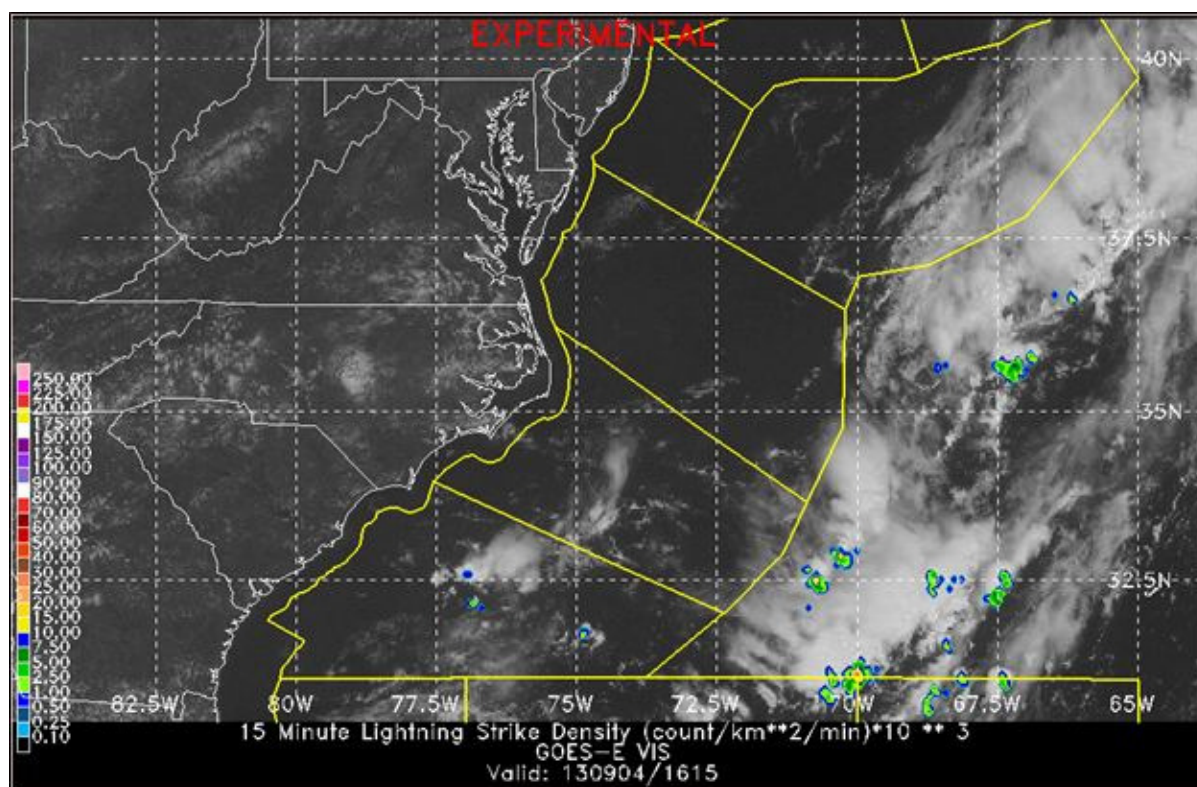


Figure 1. The 15 minute Lightning Strike Density product from 14 September 2013 shows lightning activity off the Atlantic coast.

OPC Training Marine Forecasters in Africa

The European Union Meteorological Satellite (EUMETSAT) organization sponsored a training course on the application of satellite derived winds and waves for training officers from African weather services with marine responsibility. The course ran from December 9-13, 2013. The South African Weather Service hosted the training at the World Meteorological Organization (WMO) Regional Training Center in Pretoria, South Africa. Marine meteorologists from six African weather services participated in the training. Countries represented included South Africa, Morocco, Niger, Tanzania, Kenya, and the Seychelles. The course helped meet the recommendation by the WMO that training be regularly conducted to promote the use of advanced skills in marine applications and forecasting.

Joe Sienkiewicz, Chief of the Ocean Prediction Center's Ocean Applications Branch, served as one of the instructors. Joe conducted a variety of sessions including, the use of the N-AWIPS/GEMPAK software, and presented examples of wind and wave features detected by scatterometers and altimeters.

N-AWIPS/GEMPAK is a software package for analysis, display, and product generation for meteorological data. Joe used this system to conduct several case studies and forecast exercises.

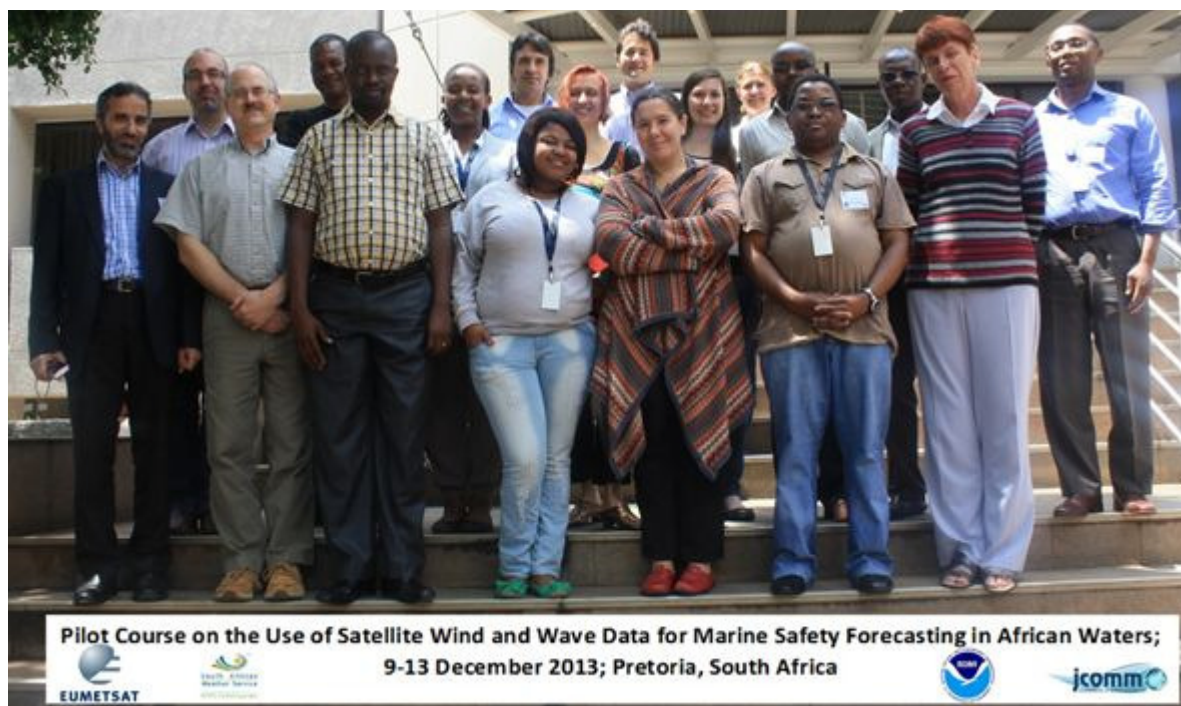


Figure 1. Forecaster/trainers and instructors on the steps of the SAWS facility in Pretoria.

The forecaster/trainers were very knowledgeable, engaging, and eager to learn about scatterometer and altimeter derived winds and waves and how to use these data sets in operations. For all the forecasters, this was their first experience using integrated display and product generation capabilities and using scatterometer winds and altimeter waves. All weather services used information available on the Internet, with several having limited capabilities on display systems such as Synergie and Ninjo. None of the forecasters have fully integrated display and product generation systems available.

Using N-AWIPS/GEMPAK from Unidata and data from a twelve day period in mid-November, the students rapidly gained experience and proficiency with the display and product generation capabilities. They were able to optimize their situational awareness by overlaying multiple data sets including satellite derived winds and waves. The use of satellite data is especially critical over the oceans where conventional observations are sparse. All forecaster/trainers were able to upload a virtual box version of N-AWIPS/GEMPAK onto their laptops and return to their national weather service with one full day of satellite, scatterometer, altimeter, observational, and Numerical Weather Prediction data for familiarization and as a seed for training other forecasters in their own country.

The multi-national team of instructors included: Dr. Paul Chang (NESDIS StAR) and Dr. Zorana Jelenak (UCAR/NESDIS StAR), Joe Sienkiewicz (NWS/NCEP Ocean Prediction Center), Dr. Mark Higgins (EUMETSAT), Dr. Julia Figa Soldano (EUMETSAT) and Dr. Ad Stofflen of the Royal Dutch Meteorological Institute (KNMI).

The instructors will continue to work with student/trainers to develop regional case studies to highlight the local weather challenges.



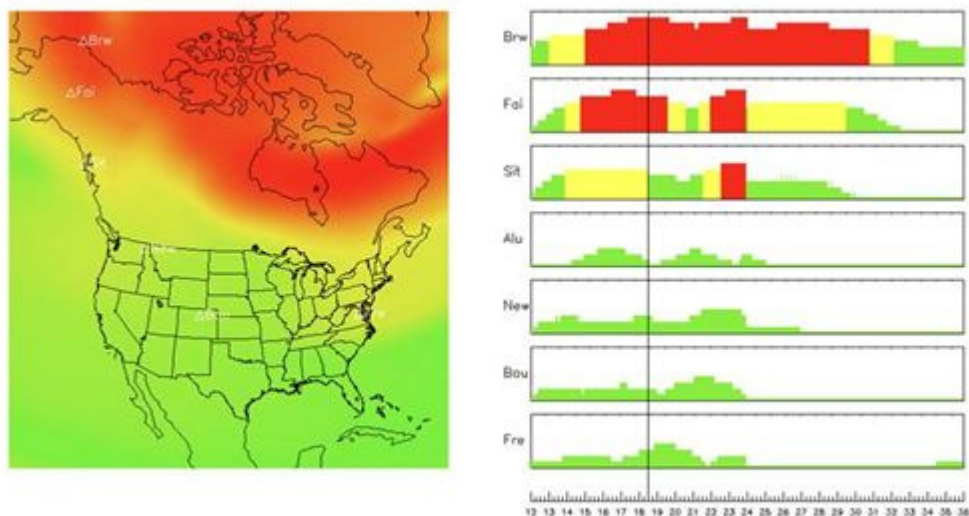
Figure 2. Flags at half mast in a park in Pretoria in honor of President Mandela.

The course coincided with the week-long memorial services for former South African President Nelson Mandela. During the memorial service in Johannesburg, the atrium of the South African Weather Service facility was set up with a large screen TV for staff and visitors to watch the service. Prior to and following the service, a number of police escorted motorcades passed by the facility. The South African Weather Service also hosted a memorial service within their building. It was a special time to be in South Africa and especially Pretoria.

SWPC Geospace Model Transition to Operations

The Nation's electric power systems are impacted by space weather. A large geomagnetic storm induces extra currents and fluctuations on the power lines which can have significant consequences. The operators of these electric power systems know how to adjust their systems to reduce the damage but they need accurate forecasts of space weather. These customers have been requesting forecasts of space weather impacts on their systems on a local or regional level. The figure below shows how a storm can impact some regions but not others. Current forecasts are global and provide only a single number for the entire world. To provide accurate regional forecasts of geomagnetic storm impacts on the electric power grid, SWPC will be implementing a full-physics Geospace model of Earth's magnetosphere developed in the academic community with support from NSF and NASA. The NASA Community Coordinated Modeling Center (CCMC) assisted in the selection process by running several Geospace models and evaluating each model's performance for a number of moderate and large geomagnetic storms. The CCMC provided its final report on 1 December 2013 and, after assessing the results of the test, SWPC has chosen to transition the Space Weather Modeling Framework (SWMF) model from the University of Michigan into operations.

The Space Weather Prediction Testbed (SWPT) has now begun to transition the SWMF model from research to operations. The SWMF source code has been provided by the University of Michigan. Scientific programmers at the SWPT have ported the code to the NCEP Zeus and WCOSS computers and are initiating the first runs to verify basic functionality. SWPC and the SWPT are developing a transition plan for this model. The goal will be to have the model running in test mode by the end of FY14 and ready for operations by the end of FY15.

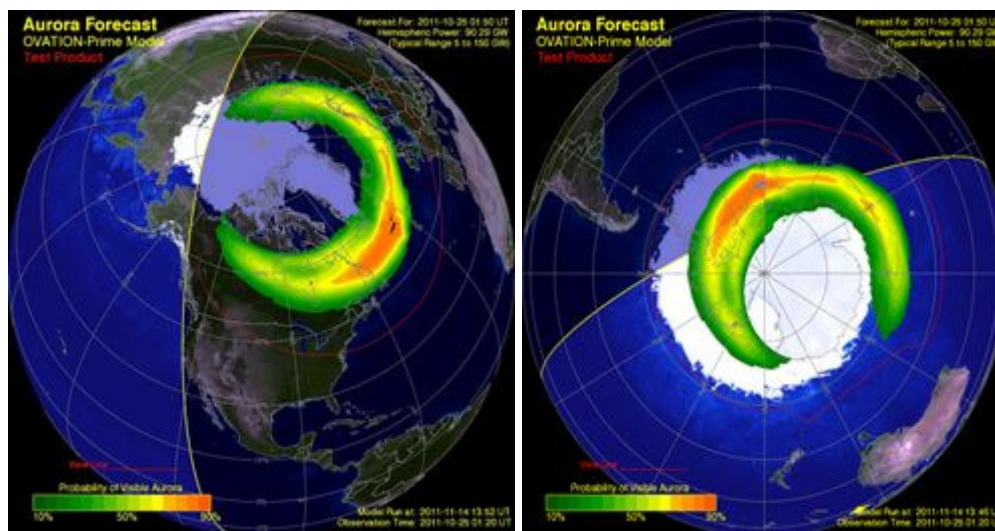


This figure shows how a geomagnetic storm impacts different regions. Plots of activity level at seven stations from Alaska to Virginia are shown individually on the right. In this example, the high latitude locations were more severely impacted.

SWPC Aurora Forecast Model Transition to Operations

The Space Weather Prediction Testbed, in partnership with NESDIS/National Geophysical Data Center and Johns Hopkins Applied Physics Lab, has developed a short-range forecast of the aurora based on the Ovation Prime model which was developed by P. Newell at Johns Hopkins. The Ovation model runs using solar wind observations from the Advanced Composition Explorer (ACE) satellite at the L1 point as input. It provides an estimate of the location and intensity of the aurora at Earth approximately 30 minutes later. There are many space weather impacts associated with the aurora so this product will have value for many customers for situational awareness. For instance, the worst ground induced currents on electric power lines occur under the aurora. Also, the latitudinal cutoff of HF communications during a Radiation Storm occurs near the equator-ward boundary of the aurora. And by far, most of the general interest in space weather is associated with when and where people might observe the aurora.

The Ovation model has been running for two years in test-mode at the NESDIS National Geophysical Data Center but has very recently been transitioned to operations at NCEP/SWPC. It has been validated by comparisons with satellite data, including the NPP/VIIRS Low Light Channel data which can observe the aurora. A 24 hour sequence of aurora has been developed for the NOAA/ESRL Science On a Sphere (SOS). Plans to improve upon the Ovation model so that it provides more accurate forecasts for the very largest storms have already been implemented. A longer-range 3-day aurora forecast model is also being developed at the Space Weather Prediction Testbed.



Two views of the Ovation model output from the northern and southern hemispheres.

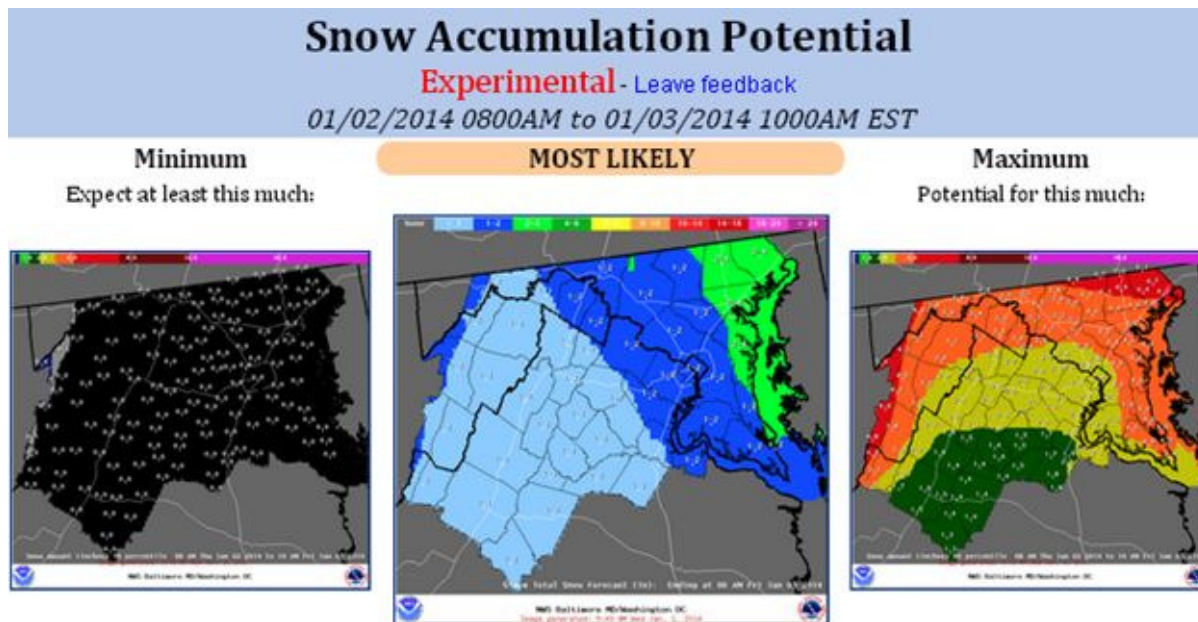
WPC Snow Accumulation Potential Product

Communicating uncertainty is a key challenge of the forecaster. This is particularly true for snowfall, where uncertainties in precipitation amount, precipitation type, and snow-to-liquid ratio are factors affecting snowfall. Despite the forecast uncertainties, critical decisions such as those to close schools, cancel flights, or ramp up snow plow staffing, are dependent on accurate snowfall forecasts. The economic and human impact of these decisions can be particularly high in populous regions such as the Washington, D.C. metro area.

The traditional method of snowfall forecasting was simply stating the most likely snowfall accumulation for a storm. Recent social science research has found that the general U.S. public prefers ranges of information relative to single-valued deterministic information. Further, the emergency management and transportation communities have evolved to consider reasonable worst-case scenarios for planning purposes. Thus, to improve communication of snowfall uncertainty, WPC is collaborating with the WFO Sterling Pilot Project on local probabilistic snowfall products.

In collaboration with WPC, WFO Sterling implemented a 'Minimum', 'Most Likely', and 'Maximum' snowfall scenario product for local decision support activities. The product is based on the WPC probabilistic winter precipitation forecast (PWPF) snowfall information, which is derived from a single-valued deterministic snowfall forecast and over 30 unique numerical model forecasts. The result is a range of possible outcomes depending on the spread of the model forecasts. To communicate the forecast uncertainty, meteorologists at WFO Sterling initialize three scenarios with WPC probabilistic data directly, and then modify as necessary. An example in the figure below highlights outcomes on the low and high ends of the range, as well as a "most likely" single-valued solution that falls near the center of the range. The product provides decision makers reasonable best and worst-case scenarios to plan for, and can be used to highlight the incredible uncertainty associated with some winter storms.

The official dissemination of probabilistic information is a long standing strategic goal of the NWS. This collaboration represents a major step towards the official dissemination of probabilistic snowfall information for supporting decisions at the local level.



Experimental graphics created by the Baltimore-Washington Weather Forecast Office for Emergency Management and transportation decision makers.

<http://www.ncep.noaa.gov/newsletter/>